

What is claimed is:

1. An optical apparatus for compensating dispersed signal pulses in an optical communication system, said optical apparatus comprising:

an input port for receiving dispersed signal pulses and an output port for exiting of compensated pulses;

a first means for aligning the axes of polarization;

at least one means for directing said axes of polarization to divergent paths that is coupled to said means for aligning the axes of polarization;

a plurality of means for retarding polarization coupled to said means for directing said axes of polarization to divergent paths, in a ratio of two said means for retarding polarization per one said means for directing said axes of polarization to divergent paths;

and a plurality of optical filter means for compensating group delay in an incoming axis of polarized light coupled to said means of retarding polarization, in a ratio of two said optical filter means for compensating group delay in an incoming axis of polarized light per one said means for directing said axes of polarization to divergent paths;

2. The optical apparatus of Claim 1 wherein the optical filter means are selected from the group of infinite impulse response filters comprising: all-pass filters, Gires-Tournois interferometers, Gires-Tournois etalons, balanced Fabry-Perot filters, and chirped fiber Bragg gratings.

3. The optical apparatus of Claim 1 wherein said optical filter means for compensating group delay in an incoming axis of polarized light are multi-cavity Gires-Tournois resonators.

4. The optical apparatus of Claim 1 wherein at least one of said optical filters for compensating group delay displays an inverse group delay versus wavelength function relative to at least one of other said optical filter means for compensating group delay in an incoming axis of polarized light.

5. The optical apparatus of Claim 1 wherein polarization mode dispersion of said dispersed signal pulses can be compensated.

6. The optical apparatus of Claim 4 wherein chromatic dispersion and polarization mode dispersion of said dispersed signal pulses can be compensated concurrently or independently.

7. The optical apparatus of Claim 1 wherein the means for aligning the axes of polarization is dynamic.

8. The optical apparatus of Claim 1 wherein said optical filter means for compensating group delay in an incoming axis of polarized light are tunable optical filters.

9. The optical apparatus of Claim 8 wherein said tunable optical filters are tuned by a feedback mechanism comprising an optical monitor and a controller.

10. The optical apparatus of Claim 8 wherein at least two of said tunable optical filters are tuned in tandem.

11. The optical apparatus of Claim 1 wherein two said means for directing said axes of polarization to divergent paths are optically coupled;

and wherein said output port for exiting of compensated pulses is optically coupled to one of said means for directing said axes of polarization to divergent paths.

12. The optical apparatus of Claim 1 wherein said means for directing said axes of polarization to divergent paths comprises at least one beam displacer;

and wherein said output port for exiting of compensated pulses is optically coupled to said beam displacer.

13. An optical apparatus for compensating dispersed signal pulses in an optical communication system, said optical apparatus comprising:

an input port for receiving dispersed signal pulses and an output port for exiting of compensated pulses;

a first means for aligning the axes of polarization that is optically coupled to said input port;

and a plurality of optical filter means for compensating group delay in an incoming axis of polarized light coupled to said means for directing said axes of polarization to divergent paths, in a ratio of two said optical filter means for compensating group delay in an incoming axis of polarized light per one said means for directing said axes of polarization to divergent paths;

and wherein said output port for the exit of compensated pulses is coupled to one of said means for directing the said axes of polarization to divergent paths.

14. The optical apparatus of Claim 1 wherein said optical apparatus for compensating dispersed signal pulses further includes a circulator disposed between, and optically coupled to said means for aligning the axes of polarization and said means for directing said axes of polarization to divergent paths.

15. The optical apparatus of Claim 1 wherein a plurality of optical filter means for compensating group delay in a dispersed signal pulse are coupled to a circulator;

and wherein chromatic dispersion can be compensated by said plurality of optical filter means for compensating group delay in a dispersed signal pulse;

and polarization mode dispersion can be compensated by a plurality of said optical filter means for compensating group delay in an incoming axis of polarized light;

and said circulator is optically coupled to said means for aligning the axes of polarization, and said output port for the exit of compensated pulses.

16. An optical apparatus for compensating dispersed signal pulses comprising:

an input port for receiving dispersed signal pulses and an output port for exiting of compensated pulses;

a first means for aligning the axes of polarization that is optically coupled to said input port;

a means for directing said axes of polarization to divergent paths that is coupled to said means for aligning the axes of polarization;

at least one first optical filter means for compensating group delay in an incoming axis of polarized light that is coupled to the first output of said means for directing said axes of polarization to divergent paths;

at least one second optical filter means for compensating group delay in an incoming axis of polarized light that is coupled to a second output of a means for directing said axes of polarization to divergent paths

and a means for combining compensated signal pulses exiting said first optical filter means for compensating group delay in an incoming axis of polarized light, and second optical filter means for compensating group delay in an incoming axis of polarized light.

17. The optical apparatus of Claim 16 wherein the optical filter means for compensating group delay in an incoming axis of polarized light are selected from the group consisting of: cascaded ring resonator filters, coupled ring resonators, and lattice ring resonators.

18. An optical apparatus for compensating dispersed signal pulses comprising:

an input port for receiving dispersed signal pulses and an output port for exiting of compensated pulses;

a first means for aligning the axes of polarization that is optically coupled to said input port;

a means for directing said axes of polarization to divergent paths that is coupled to said means for aligning the axes of polarization;

a first mirror means for redirecting an incoming axis of polarization disposed between said means for directing said axes of polarization to divergent paths and a first optical filter means for compensating group delay in an incoming axis of polarized light;

a second mirror means for redirecting an incoming axis of polarization disposed between said first optical filter means to compensate group delay in an incoming axis of polarized light and a means for combining incoming axes of polarized light;

at least one second optical filter means for compensating group delay in an incoming axis of polarized light that is coupled to said means for directing said axes of polarization to divergent paths and said means for combining incoming axes of polarized light.

19. The optical apparatus of Fig. 18 further including additional optical filter means to compensate group delay in an incoming axis of polarized light coupled to one another and disposed between said first mirror means for redirecting an incoming axis of polarization and said second mirror means for redirecting an incoming axis of polarization

20. The optical apparatus of claim 18 wherein one or more optical filter means to compensate group delay in an incoming axis of polarized light are selected from a group of finite impulse response filters comprising: Mach-Zehnder interferometers, Mach-Zehnder filters, Michelson interferometers, Michelson filters and arrayed waveguides.

21. The method for polarization mode dispersion compensation of a dispersed signal pulse comprising the steps of:

aligning the axes of polarization;

directing each axis of polarized light to a delay element;

changing each linearly oriented axis of polarized light into circularly polarized light axes;

imposing a change in group delay on each axis of said circularly polarized light;

changing the polarization of each axis of said circularly polarized, group delayed light;

and recombining the said two axes of circularly polarized, group delayed light.

22. The method of Claim 21 further comprising the steps of:

directing each axis of polarized light to an additional delay element;

changing each linearly oriented axis of polarized light into circularly polarized light axes;

imposing a change in group delay on each axis of said circularly polarized light;

imposing a change in group delay on each axis of said circularly polarized light;

changing the polarization of each axis of circularly polarized, group-delayed light;

and recombining the said two axes of circularly polarized, group-delayed light;

23. The method of Claim 22 wherein two of four optical filters for imposing a change in group delay on each axis of polarized light exhibit the inverse group delay function of the two others.

24. The method of Claim 22 wherein chromatic dispersion of said dispersed signal pulse is compensated concurrently or independently.